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Patent  
New Attorney Docket No.: 85773-454**REMARKS****A. Summary of Amendments**

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The specification has been amended to address an informality detected by the Examiner.

The application now contains 36 claims, numbered 2-16, 18-38.

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Allowance of claim 36 is gratefully acknowledged.

Claims 1 and 17 have been cancelled.

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New claim 38 has been added.

Claims 2, 16, 18, 27-28, 32 and 37 have been amended.

20

It is noted that claims 2-16, 18-26 and 28-34 have been amended to replace the expression "an optical switch" with "an optical switching system" so as to provide proper antecedent basis for the claim language therein.

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The Applicant respectfully submits that support for the claim amendments and new claim 38 exists in the specification as originally filed, and that no new matter has been added to the application.

**B. Objections to the specification**

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On page 2 of the Office Action, the Examiner has objected to the specification, more specifically to lines 6-12 on page 1, as reciting a cross reference that is no longer co-pending. The Applicant respectfully submits that by associating the issued patent number to each cross-referenced application, the specification is now in allowable form.

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Patent  
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On page 2 of the Office Action, the Examiner has objected to former claim 37, more specifically to line 13, which recites "the first output is connected to the second output". In response, the Applicant has amended claim 37 and respectfully submits that appropriate correction of this typo has been made.

**D. Rejection of claims 32 and 37 under 35 U.S.C. § 112**

On page 2 of the Office Action, the Examiner has rejected claims 32 and 37 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter of the invention. In response, the Applicant has amended claims 32 and 37 and respectfully submits that proper antecedent basis has been provided. It is believed that claims 32 and 37 are now in full compliance with 35 U.S.C. § 112, second paragraph and the Examiner is respectfully requested to withdraw his rejection of claims 32 and 37.

**E. Rejection of claims 2-5, 7, 9 and 27-28 under 35 U.S.C. § 102**

On page 2 of the Office Action, the Examiner has rejected claims 2-5, 7, 9 and 27-28 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,457,556 (hereinafter referred to as Shiragaki). The Applicant respectfully traverses this rejection and submits that the amended claims are now in allowable form, as discussed herein below.

**CLAIM 2**

As can be appreciated from Shiragaki, notably from Fig. 2 and the accompanying description, the outputs of the multiplexers 14-1, 14-2 contain wavelength division multiplexed signals which are fed to the space switch 10 via its input ports 15. At the space switch 10, the received wavelength division multiplexed signals are simply switched, and exit the space switch 10 via its output ports 18. No combining of

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grouped optical channels is performed by anything even remotely resembling the claimed "third coupler for combining grouped optical channels".

Moreover, it can be observed that the wavelength division multiplexed signals exiting the multiplexers 14-1, 14-2 both contain the same optical carriers, albeit with distinct signals occupying those optical carriers. It would thus be counterproductive to Shiragaki's device to combine these wavelength division multiplexed signals using a hypothetical third coupler, as such an action would cause interference between signals appearing in two different wavelength division multiplexed signals but sharing the same optical carrier.

Since claim 2 recites at least one limitation that is not taught or suggested in the cited reference, it is respectfully submitted that claim 2 is not anticipated and the Examiner is respectfully requested to withdraw his rejection of claim 2.

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CLAIMS 3-5, 7, 9 and 12

Claims 3-5, 7, 9 and 12 are dependent from claim 2 and as such contain all the limitations present in that claim. Therefore, for the same reasons as those set forth in support of claim 2, the Examiner is respectfully requested to withdraw his rejection of claims 3-5, 7, 9 and 12.

CLAIM 27

The Examiner's attention is directed to the following limitations of independent claim 27:

An optical switching system comprising

a first logical layer for switching optical channels;

a second logical layer for switching a group of optical channels; and

a first coupler for grouping together optical channels of the first logical layer and coupling them to the second logical layer; and

a second coupler for ungrouping grouped optical channels of the

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second logical layer and coupling them to the first logical layer.

5 The Applicant fails to see how Shiragaki can be applied to this claim. Nowhere in Shiragaki is there disclosed a logical layer for switching optical channels or a group of optical channels. Rather, any reference to switching in Shiragaki is purely from a physical standpoint. There is no possibility in Shiragaki for different switching functions to be performed by logical layers without reference to their physical interrelationship.

10 Since claim 27 recites at least one limitation that is not taught or suggested in the cited reference, it is respectfully submitted that claim 27 is not anticipated and the Examiner is respectfully requested to withdraw his rejection of claim 27.

#### CLAIM 28

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Claim 28 is dependent from claim 27 and as such contain all the limitations present in that claim. Therefore, for the same reasons as those set forth in support of claim 27, the Examiner is respectfully requested to withdraw his rejection of claim 28.

#### 20 F. Rejection of claims 6 and 8 under 35 U.S.C. § 103

On page 4 of the Office Action, the Examiner has rejected claims 6 and 8 under 35 U.S.C. § 103(a) as being unpatentable over Shiragaki in view U.S. Patent No. 6,341,040 (hereinafter referred to as Tai *et al.*). The Applicant respectfully traverses  
25 this rejection and submits that claims 6 and 8 are in allowable form, as discussed herein below.

Claims 6 and 8 are dependent on claim 2 and therefore include all of the limitations of claim 2, including the limitation already shown to be missing from Shiragaki, namely a  
30 "third coupler for combining grouped optical channels". It is respectfully submitted that this limitation is also not disclosed in Tai *et al.*.

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Specifically, Tai *et al.* discloses a multi-plate comb filter including glass plates. An interleaver / deinterleaver is added to increase the capacity of the optical network. However, Tai *et al.* is silent on the use of any third coupler as recited in claims 6 and 8 of the Instant application. This is not surprising, as Tai *et al.* is more concerned with the optical properties of the comb filter than with switching architectures. It will be apparent that Tai *et al.* is in fact totally silent on the switching of grouped optical channels in general and the claimed third coupler in particular. Since Tai *et al.* fails to disclose at least one limitation of claims 6 and 8 already shown to be missing from Shiragaki, the Applicant respectfully submits that there is at least one criterion, required for the Examiner to establish a *prima facie* case of obviousness, which has not been met<sup>1</sup>. The Examiner is therefore respectfully requested to withdraw his rejection of claims 6 and 8.

**G. Rejection of claims 10-11, 13-16 and 29-30 under 35 U.S.C. § 103**

On page 5 of the Office Action, the Examiner has rejected claims 10-11, 13-16 and 29-30 under 35 U.S.C. § 103(a) as being unpatentable over Shiragaki in view of H. Kuwano, "MEMS for Telecommunication Systems", Seventh International Symposium on Micro Machine and Human Science, IEEE 1996 and C. Marxer, "MEMS for Applications in Fiber Optic Communication", IEEE 1998 (hereinafter referred to as Kuwano and Marxer *et al.*, respectively). The Applicant respectfully traverses this rejection and submits that claims 10-11, 13-16 and 29-30 are in allowable form, as discussed herein below.

**CLAIMS 10-11 and 13-16**

Claims 10, 11 and 13-16 are dependent on claim 2 and therefore include all of the limitations of claim 2, including the limitation already shown to be missing from Shiragaki, namely a "third coupler for combining grouped optical channels". It is

<sup>1</sup>For the Examiner to establish a *prima facie* case of obviousness, three criteria must be considered: (1) there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings, (2) there must be a reasonable expectation of success, and (3) the prior art references must teach or suggest all of the claim limitations. MPEP §§ 706.02(j), 2142 (8<sup>th</sup> ed.).

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respectfully submitted that this limitation is also not disclosed in either Kuwano or Marxer *et al.*.

Specifically, Kuwano sets forth an article that describes the state of MEMS technologies in the field of telecommunications. An optical matrix switch is described in Fig. 2(a). However, Kuwano is silent on the use of any third coupler as recited in claims 10, 11 and 13-16 of the instant application. This is not surprising, as Kuwano is more concerned with the problems of micro-machining than with switching architectures. It will be apparent that Kuwano is in fact totally silent on the switching of grouped optical channels in general and the claimed third coupler in particular.

In much the same way, Marxer *et al.* sets forth an article that describes several MEMS-based components for fiber optical communication. A 2x2 fiber optic switch is discussed at some length on pages 26 and 27 of the article. However, Marxer *et al.* is silent on the use of any third coupler as recited in claims 10, 11 and 13-16 of the instant application. This is not surprising, as Marxer *et al.* is more concerned with the description of specific components than with switching architectures. It will be apparent that Marxer *et al.* is in fact totally silent on the switching of grouped optical channels in general and the claimed third coupler in particular.

Since both Kuwano and Marxer *et al.* fail to disclose at least one limitation of claims 10, 11 and 13-16 already shown to be missing from Shiragaki, the Applicant respectfully submits that there is at least one criterion, required for the Examiner to establish a *prima facie* case of obviousness, which has not been met. The Examiner is therefore respectfully requested to withdraw his rejection of claims 10, 11 and 13-16.

#### CLAIMS 29-30

Claims 29-30 are dependent from claim 27, and as such contain all the limitations present in that claim, including the limitation already shown to be missing from Shiragaki, namely a logical layer for switching optical channels or a group of optical channels. It is respectfully submitted that this limitation is also not disclosed in

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Patent  
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As discussed above, Kuвано sets forth an article that describes the state of MEMS technologies in the field of telecommunications. An optical matrix switch is described in Fig. 2(a). However, Kuвано is silent on the use of logical layers as recited in claims 29 and 30. This is not surprising, as Kuвано is more concerned with the problems of micro-machining than with switching architectures. It will be apparent that Kuвано is in fact totally silent on the use of a logical layer for switching optical channels or a group of optical channels.

10

In much the same way, Marxer *et al.* sets forth an article that describes several MEMS-based components for fiber optical communication. A 2x2 fiber optic switch is discussed at some length on pages 26 and 27 of the article. However, Marxer *et al.* is silent on the use of logical layers as recited in claims 29 and 30 of the instant application. This is not surprising, as Marxer *et al.* is more concerned with the description of specific components than with switching architectures. It will be apparent that Marxer *et al.* is in fact totally silent on the use of a logical layer for switching optical channels or a group of optical channels in particular.

15

Since both Kuвано and Marxer *et al.* fail to disclose at least one limitation of claims 29 and 30 already shown to be missing from Shiragaki, the Applicant respectfully submits that there is at least one criterion, required for the Examiner to establish a *prima facie* case of obviousness, which has not been met. The Examiner is therefore respectfully requested to withdraw his rejection of claims 29 and 30.

25

#### H. Rejection of claims 18-24 and 35 under 35 U.S.C. § 103

On page 6 of the Office Action, the Examiner has rejected claims 17-24 and 35 under 35 U.S.C. §103(a) as being unpatentable over Shiragaki in view of European Patent Application EP 1,030,481 (hereinafter referred to as Morthier). The Applicant respectfully traverses this rejection and respectfully submits that claims 18-24 and 35 are in condition for allowance.

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5 Claim 18 is dependent from claim 2, and as such contains all the limitations present in that claim.

10 Firstly, regarding Shiragaki, this reference discloses an optical cross-connect system wherein traffic from upstream nodes "can be directly switched through the space switch 10 to downstream nodes via the outlet ports 17 without being decomposed into their individual components and others may be switched via the outlet ports 18 to demultiplexers 12, where they are decomposed into signals of lower level of multiplexing or baseband signals" (col. 5, lines 27-34). Demultiplexers 12 feed the lower level signals into wavelength switch 13, which are multiplexed back into WDM traffic by multiplexers 14 and fed back into space switch 10.

15

For its part, Morthier teaches an optical cross-connect device for WDM signals. Figures 4-12 teach "the combined use of tunable filters 20 and splitters 21 [which] results in selective partial demultiplexing in which individual channels may be selectively demultiplexed from a group of channels" (col. 14, lines 18-21).  
20 Immediately following fiber-level switching, splitters 21 duplicate the full WDM signals. For each incoming WDM trunk, filters 20 *select* a subset (half) of the WDM channels. These selected wavelengths are allowed to bypass optical cross-connect (OXC) 19, while the other half, the *group* of channels is fed into OXC 19. At the output, combiners 22 reassemble individual channels and partially demultiplexed channel  
25 groups.

Now, if one were to "combine the teachings of Morthier to the switching system of Shiragaki to modify Fig. 2 or Fig. 9 of Shiragaki", as the Examiner suggests on page 6 of the Office Action, one would obtain a hypothetical cross-connect system in which  
30 the wavelength switch 13 of Shiragaki has been replaced by the cross-connect device of Morthier. The wavelength switch 13 of Shiragaki as modified by Morthier thus selects portions of the WDM signals at ports 21 (of Shiragaki) to feed into a optical



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cross-connect (OXC) with the remaining portions bypassing the OXC. This only makes sense if the demultiplexers 12-1, 12-2 provide demultiplexing to a lower level of multiplexing, rather than at the optical channel level. Under such circumstances, the wavelength switch 13 of Shiragaki as modified by Morthier would provide  
5 selective partial demultiplexing of multiplexed signals arriving at the switch 13 via ports 21.

However, the resulting hypothetical architecture merges channel switching and channel group switching into a single one-time pass through the wavelength switch  
10 13. What the resulting hypothetical architecture lacks is a first layer for switching optical channels, a second layer for switching a group of optical channels and an arrangement of couplers that connects the two layers. The absence of the first and second layers of switching in the resulting hypothetical architecture render it impossible to exert independent control of channel switching and channel group  
15 switching. Clearly, therefore, the hypothetical device resulting from the combination of Shiragaki and Morthier would fall short of teaching or suggesting the claimed switching architecture.

Thus, it is respectfully submitted that claim 18 is not obvious in view of the  
20 combination of Shiragaki and Morthier, and hence the Examiner is respectfully requested to withdraw his rejection of claim 18.

#### CLAIMS 19-24

25 Claims 19-24 are dependent from claim 18 and as such contain all the limitations present in that claim. Therefore, for the same reasons as those set forth in support of claim 18, the Examiner is respectfully requested to withdraw his rejection of claims 19-24.

#### 30 CLAIM 35

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The Examiner's attention is directed to the following limitations of independent claim 35:

An optical switching system for switching optical signals in wavelength groups, the system comprising:

5 a first optical switching matrix ... being operable to switch a composite optical signal composed of a plurality of optical channel signals from any one of a plurality of the inputs to any one of a plurality of the outputs;

10 a plurality of second optical switching matrices ... being operable to switch a group of optical channel signals from any one of a plurality of the inputs to any one of a plurality of the outputs;

15 at least one first wavelength division multiplexer coupled at each of its inputs to an output of a respective one of the plurality of second optical switching matrices and coupled at its output to one of the inputs of the first optical switching matrix;

20 a plurality of third optical switching matrices ... being operable to switch an optical channel signal from any one of a plurality of the inputs to anyone of a plurality of the outputs; and

25 a plurality of second wavelength division multiplexers, each second multiplexer coupled at each of its inputs to an output of a respective one of the plurality of third optical switching matrices for combining optical channels into a group of optical channels and coupled at its output to one of the inputs of a corresponding one of the plurality of second optical switching matrices.

30 As discussed above, Shiragaki discloses an optical cross-connect system wherein traffic from upstream nodes "can be directly switched through the space switch 10 to downstream nodes via the outlet ports 17 without being decomposed into their individual components and others may be switched via the outlet ports 18 to demultiplexers 12, where they are decomposed into signals of lower level of multiplexing or baseband signals" (col. 5, lines 27-34). Demultiplexers 12 feed the

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lower level signals into wavelength switch 13, which are multiplexed back into WDM traffic by multiplexers 14 and fed back into space switch 10.

- For its part, Morthier teaches an optical cross-connect device for WDM signals.
- 5 Figures 4-12 teach "the combined use of tunable filters 20 and splitters 21 [which] results in selective partial demultiplexing in which individual channels may be selectively demultiplexed from a group of channels" (col. 14, lines 18-21). Immediately following fiber-level switching, splitters 21 duplicate the full WDM signals. For each incoming WDM trunk, filters 20 *select* a subset (half) of the WDM channels.
- 10 These selected wavelengths are allowed to bypass optical cross-connect (OXC) 19, while the other half, the *group* of channels is fed into OXC 19. At the output, combiners 22 reassemble individual channels and partially demultiplexed channel groups.
- 15 Now, if one were to "combine the teachings of Morthier to the switching system of Shiragaki to modify Fig. 2 or Fig. 9 of Shiragaki", as the Examiner suggests on page 6 of the Office Action, one would obtain a hypothetical cross-connect system in which the wavelength switch 13 of Shiragaki has been replaced by the cross-connect device of Morthier. The wavelength switch 13 of Shiragaki as modified by Morthier thus
- 20 selects portions of the WDM signals at ports 21 (of Shiragaki) to feed into a optical cross-connect (OXC) with the remaining portions bypassing the OXC. This only makes sense if the demultiplexers 12-1, 12-2 provide demultiplexing to a lower level of multiplexing, rather than at the optical channel level. Under such circumstances, the wavelength switch 13 of Shiragaki as modified by Morthier would provide
- 25 selective partial demultiplexing of multiplexed signals arriving at the switch 13 via ports 21.

- However, the resulting hypothetical architecture merges channel switching and channel group switching into a single one-time pass through the wavelength switch
- 30 13. What the resulting hypothetical architecture lacks is a first optical switching matrix being operable to switch optical signals composed of a plurality of optical channel signals, a plurality of second optical switching matrices being operable to switch a

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group of optical channel signals, and an arrangement of wavelength division multiplexers/demultiplexers that connects the first optical switching matrix and the second plurality of optical switching matrices. The absence of the first optical switching matrix and the second plurality of optical switching matrices in the resulting hypothetical architecture render it impossible to exert independent control of channel switching and channel group switching. Clearly, therefore, the hypothetical device resulting from the combination of Shiragaki and Morthier would fall short of teaching or suggesting the claimed switching architecture.

Thus, it is respectfully submitted that claim 35 is not obvious in view of the combination of Shiragaki and Morthier, and hence the Examiner is respectfully requested to withdraw his rejection of claim 35.

**I. Rejection of claims 25-26 and 33-34 under 35 U.S.C. § 103**

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On page 6 of the Office Action, the Examiner has rejected claims 25-26 and 33-34 under 35 U.S.C. § 103(a) as being unpatentable over Shiragaki in view U.S. Patent No. 6,192,172 (hereinafter referred to as Fatehi *et al.*). The Applicant respectfully traverses this rejection and submits that claims 25-26 and 33-34 are in allowable form, as discussed herein below.

**CLAIMS 25-26**

Claims 25 and 26 are dependent on claim 2 and therefore include all of the limitations of claim 2. As stated before in respect of claim 2, from Shiragaki's Fig. 2 and the accompanying description, the outputs of the multiplexers 14-1, 14-2 contain wavelength division multiplexed signals which are fed to the space switch 10 via its input ports 15. At the space switch 10, the received wavelength division multiplexed signals are simply switched, and exit the space switch 10 via its output ports 18. No combining of grouped optical channels is performed by anything even remotely resembling the claimed "third coupler for combining grouped optical channels".

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Moreover, it can be observed that the wavelength division multiplexed signals exiting the multiplexers 14-1, 14-2 both contain the same optical carriers, albeit with distinct signals occupying those optical carriers. It would thus be counterproductive to Shiragaki's device to combine these wavelength division multiplexed signals using a hypothetical third coupler, as such an action would cause interference between signals appearing in two different wavelength division multiplexed signals but sharing the same optical carrier.

Now, it is respectfully submitted that Fatehi *et al.* does nothing to bridge the already wide gap existing between Shiragaki and the invention claimed herein. In fact, Fatehi *et al.* merely discloses an optical wavelength-space cross-connect switch architecture. Instead of using one single switching fabric, Fatehi *et al.* uses a plurality of wavelength-selective optical cross-connect switch fabrics. Thus, Fatehi *et al.* potentially provides an alternative embodiment for the wavelength switch of Shiragaki (item 13 in Fig. 2 of that reference). However, the device resulting from using Fatehi *et al.* in combination with Shiragaki still suffers the same deficiencies as those outlined above in respect of Shiragaki taken alone.

Therefore, it is respectfully submitted that claims 25 and 26 are not obvious in view of the combination of Shiragaki and Fatehi *et al.*, and thus the Examiner is respectfully requested to withdraw his rejection of claims 25 and 26.

#### CLAIMS 33-34

Claims 33-34 are dependent from claim 27, and as such contain all the limitations present in that claim, including the limitation already shown to be missing from Shiragaki, namely a logical layer for switching optical channels or a group of optical channels. It is respectfully submitted that this limitation is also not disclosed in Fatehi *et al.*

As discussed above, Fatehi *et al.* Merely discloses an optical wavelength-space cross-connect switch architecture. Instead of using one single switching fabric, Fatehi

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5 *et al.* uses a plurality of wavelength-selective optical cross-connect switch fabrics. Thus, Fatehi *et al.* potentially provides an alternative embodiment for the wavelength switch of Shiragaki (item 13 in Fig. 2 of that reference). However, the device resulting from using Fatehi *et al.* in combination with Shiragaki still suffers the same deficiencies as those outlined above with respect to Shiragaki taken alone.

10 Therefore, it is respectfully submitted that claims 33 and 34 are not obvious in view of the combination of Shiragaki and Fatehi *et al.*, and thus the Examiner is respectfully requested to withdraw his rejection of claims 33 and 34.

10 **J. Rejection of claims 31-32 under 35 U.S.C. § 103**

15 On page 7 of the Office Action, the Examiner has rejected claims 31-32 under 35 U.S.C. § 103(a) as being unpatentable over Shiragaki in view of Fatehi *et al.* The Applicant respectfully traverses this rejection and submits that claims 31-32 are in allowable form, as discussed herein below.

20 Claims 31 and 32 are dependent on claim 27 and therefore include all of the limitations of claim 27. As stated before in respect of claim 27, the Applicant fails to see how Shiragaki can be applied to this claim. Nowhere in Shiragaki is there disclosed a logical layer for switching optical channels or a group of optical channels. Rather, any reference to switching in Shiragaki is purely from a physical standpoint. There is no possibility in Shiragaki for different switching functions to be performed by logical layers without reference to their physical interrelationship.

25 It is respectfully submitted that this limitation is also not disclosed in Fatehi *et al.* In fact, Fatehi *et al.* merely discloses an optical wavelength-space cross-connect switch architecture. Instead of using one single switching fabric, Fatehi *et al.* uses a plurality of wavelength-selective optical cross-connect switch fabrics. Fatehi *et al.* is just as silent as Shiragaki on the use of a logical layer for switching optical channels or a group of optical channels. This is not surprising, as Fatehi *et al.* is deeply concerned with the distinct physical makeup of the resulting switching architecture.

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5 Since Fatehi *et al.* fails to disclose at least one limitation of claims 31 and 32 already shown to be missing from Shiragaki, the Applicant respectfully submits that there is at least one criterion, required for the Examiner to establish a *prima facie* case of obviousness, which has not been met. The Examiner is therefore respectfully requested to withdraw his rejection of claims 31 and 32.

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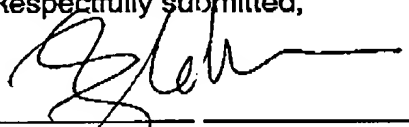
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5 In view of the foregoing, the Applicant respectfully submits that claims 2-16 and 18-37 are in allowable form. Favourable reconsideration is requested. Early allowance of the Application is earnestly solicited.

10 If the application is not considered to be in full condition for allowance, for any reason, the Applicant respectfully requests the constructive assistance and suggestions of the Examiner in drafting one or more acceptable claims pursuant to MPEP 707.07(j) or in making constructive suggestions pursuant to MPEP 706.03 so that the application can be placed in allowable condition as soon as possible and without the need for further proceedings.

Respectfully submitted,

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